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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/634,437	08/05/2003	Zhendong Lin	02024US	8285

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EXAMINER

CHEN, ERIC BRICE

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 06/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/634,437	LIU ET AL.	
	Examiner	Art Unit	
	Eric B. Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 8/5/03.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) 8-10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-10 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>3/21/05;10/31/03</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-7, drawn to a composition, classified in class 252, subclass 79.1.
 - II. Claims 8-10, drawn to a method, classified in class 438, subclass 35.
2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case, the composition can be used to clean any article and is not limited to polishing of semiconductor substrates.
3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper. Moreover, because these inventions are distinct for the reasons given above and the search required for Invention I is not required for Invention II, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Blake T. Beiderman on May 10, 2005, a provisional election was made without traverse to prosecute Invention I, claims 1-7. Affirmation of this election must be made by applicant in replying to this Office action.

Art Unit: 1765

Claims 8-10 are withdrawn from further consideration by the examiner, 37

CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Priority

6. Applicant is advised of possible benefits under 35 U.S.C. 119(a)-(d), wherein an application for patent filed in the United States may be entitled to the benefit of the filing date of a prior application filed in a foreign country.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 3 appears to be an alternative expression in the form of a Markush group. Alternative expressions are permitted if they present no uncertainty or ambiguity with respect to the question of scope or clarity of the claims. One acceptable form of alternative expression, which is commonly referred to as a Markush group,

Art Unit: 1765

recites members as being "selected from the group consisting of A, B and C." See *Ex parte Markush*, 1925 C.D. 126 (Comm'r Pat. 1925); see also MPEP § 2173.05(h) I.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honda et al. (U.S. Patent No. 6,361,712), in view of Andideh et al. (U.S. Patent No. 6,548,399) and Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002).

11. As to claim 1, Honda discloses an aqueous polishing composition comprising: a corrosion inhibitor for limiting removal of an interconnect metal (column 2, lines 41-46); an acidic pH (column 3, lines 19-24); and an organic-containing ammonium salt formed with R₁, R₂, R₃ and R₄ are radicals, R₁ has a carbon chain length of 2 to 15 carbon atoms (column 3, lines 4-8).

12. Honda does not expressly disclose that the organic-containing ammonium salt has a concentration that accelerates TEOS removal and decreases removal of at least one coating selected from the group consisting of SiC, SiCN, Si₃N₄ and SiCO.

However, Andideh teaches the use of a polish stop layer during chemical mechanical polishing to control the duration of the polishing step (column 1, lines 51-53) and to avoid excess removal of the dielectric material subjected to polishing (column 58-60).

Art Unit: 1765

Polish stop layer materials include silicon nitride (column 1, lines 53-54) or carbon doped oxide (column 2, lines 51-55). Moreover, Andideh teaches the CMP removal of dielectric layer (108), such as silicon oxide or TEOS (column 5, lines 8-14), at a faster rate than the polish stop layer (112/102) (Figure 1D-1E), in order to prevent removal of active regions (106/107) underlying the polish stop layer (column 5, lines 33-43).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an organic-containing ammonium salt with a concentration that accelerates TEOS removal and decreases removal of at least one coating selected from the group consisting of SiC, SiCN, Si₃N₄ and SiCO. One who is skilled in the art would be motivated to use a polish stop layer to prevent excess removal of material and to adjust selectivity to decrease the removal rate of the polish stop layer.

13. Honda does not expressly disclose one polishing pressure less than 21.7 kPa (3.14 psi). However, Wolf teaches that removal rate of an oxide is dependent on CMP pressure, as governed by Preston's equation (pages 338-339; Figure 8-19). Moreover, Wolf teaches, by disclosing that the polishing pressure may be varied (Figure 8-19), that changing pressure appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 II. Polishing pressure can be varied according, depending on the desired outcome of the polishing step, such as removal rate of the dielectric. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a polishing pressure less than 21.7 kPa. One who is skilled in the art would be motivated to optimize through routine experimentation of polishing pressure. See MPEP § 2144.05 II.

Art Unit: 1765

14. As to claim 2, Honda discloses that R_1 is a substituted or unsubstituted aryl, alkyl, aralkyl, or alkaryl group that comprises 2 to 5 carbon atoms (column 3, lines 4-8).

15. As to claim 3, Honda discloses that the ammonium salt is formed with a compound selected from the group consisting of tetraethyl ammonium, tetrabutylammonium, benzyltributylammonium, benzyltrimethylammonium, benzyltriethylammonium, diallyldimethylammonium, diethylaminoethyl methacrylate, dimethylaminoethyl methacrylate, methacryloyloxyethyltrimethylammonium, 3-(methacrylamido) propyltrimethylammonium, triethylenetetramine, tetramethylguanidine, hexylamine and mixtures thereof (column 3, lines 4-8).

16. Claims 4-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mahulikar et al. (U.S. Patent No. 6,776,696), in view of Andideh.

17. As to claim 4, Mahulikar discloses an aqueous polishing composition comprising, by weight percent: 0.05 to 15 abrasive particles (column 5, lines 60-61); 0 to 10 oxidizing agent (column 5, lines 66-67); 0.0025 to 6 a corrosion inhibitor for limiting removal of an interconnect metal (column 6, lines 46-50); a pH of less than 5 (column 4, lines 40-43); and 0.001 to 3 organic-containing ammonium salt formed with R_1 , R_2 , R_3 and R_4 are radicals, R_1 has a carbon chain length of 2 to 15 carbon atoms (column 6, lines 60-64; column 7, line 1); with at least one polishing pressure less than 21.7 kPa (column 4, lines 64-67).

18. Mahulikar does not expressly disclose that the organic-containing ammonium salt has a concentration that accelerates TEOS removal and decreases removal of at least one coating selected from the group consisting of SiC, SiCN, Si_3N_4 and SiCO.

Art Unit: 1765

However, Andideh teaches the use of a polish stop layer during chemical mechanical polishing to control the duration of the polishing step (column 1, lines 51-53) and to avoid excess removal of the dielectric material subjected to polishing (column 58-60).

Polish stop layer materials include silicon nitride (column 1, lines 53-54) or carbon doped oxide (column 2, lines 51-55). Moreover, Andideh teaches the CMP removal of dielectric layer (108), such as silicon oxide or TEOS (column 5, lines 8-14), at a faster rate than the polish stop layer (112/102) (Figure 1D-1E), in order to prevent removal of active regions (106/107) underlying the polish stop layer (column 5, lines 33-43).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an organic-containing ammonium salt with a concentration that accelerates TEOS removal and decreases removal of at least one coating selected from the group consisting of SiC, SiCN, Si₃N₄ and SiCO. One who is skilled in the art would be motivated to use a polish stop layer to prevent excess removal of material and to adjust selectivity to decrease the removal rate of the polish stop layer.

19. As to claim 5, Mahulikar discloses that the abrasive comprises a silica (column 5, lines 51-52), the oxidizing agent comprises hydrogen peroxide (column 5, lines 65-66), the corrosion inhibitor comprises benzotriazole (column 6, lines 46-47) and the composition has a pH of less than 3 (column 4, lines 40-41) and an organic fluoride ammonium salt (column 6, lines 63-64).

20. As to claim 6, Mahulikar discloses that the polishing composition has a pH of 2 to 3 (column 4, lines 40-41) adjusted with nitric acid (column 6, lines 32-36).

Art Unit: 1765

21. As to claim 7, Mahulikar discloses that R_1 has a carbon chain length of 2 to 5 column 6, lines 63-64).

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Mahulikar et al. (U.S. Patent No. 6,447,563) discloses a CMP slurry with silica abrasives, an acidic pH, hydrogen peroxide oxidizer, tetramethylammonium fluoride salt, and benzotriazole corrosion inhibitor. Pasqualoni et al. (U.S. Patent No. 6,749,488) discloses a CMP slurry for TEOS polishing with silica abrasives, a basic pH, hydrogen peroxide oxidizer, tetramethylammonium fluoride salt, and benzotriazole corrosion inhibitor. Leon et al. (U.S. Patent No. 6,191,086) discloses a cleaning composition with tetraethylammonium fluoride, corrosion inhibitors, and an acidic pH.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC

May 25, 2005

NADINE G. NORTON
SUPERVISOR PATENT EXAMINER

